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ABSTRACT

College students were assigned to various study and review conditions in order to determine the effect of using a preferred or nonpreferred mode of study and of being familiar or unfamiliar with the assigned reading topic. Results of the posttest showed that reading only when one preferred this technique and was familiar with the topic produced the best examination scores. Reading only was least effective when one preferred to read only but was unfamiliar with the topic, while underlining and note taking were most effective in this situation. The findings are discussed in terms of their practical effects for students. (Author)

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The Effect of Study Techniques and Preferences on Later Recall[1]

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Success in school today demands the ability to learn from written prose. There is a great deal of disagreement, though, as to the most effective study technique to use in reading an assignment. Several studies comparing the effects of the study procedures of reading only, reading and underlining, and reading and taking notes, or various combinations of these and other techniques found little, if any, increase in learning resulting from the techniques of underlining and note taking (Noal, 1962; Howe, 1970). Idstein and Jenkins (1972) did not find underlining superior to repetitive reading. In constrast, several recent studies including one by Annis and Davis (1975) found that subjects permitted to take notes recalled significantly more than subjects instructed not to take notes. Two studies showed slight advantages for underlining only under certain circumstances (Mathews, 1938; Arnold, 1942). The source of these inconsistent results is the concern of this study.

A possible cause of these inconsistent results is that in previous studies subjects have been arbitrarily assigned to a treatment condition, such as being told to take notes as they read an assignment, without any concern for what treatment is best for the subject. A subject who prefers to underline might have been assigned to a note taking condition or vice versa in the previous studies. Yet it seems likely that an individual's preference or nonpreference for an assigned treatment condition would either increase or impair a learner's success in a given instructional treatment. Prior to the present study a normative study was conducted to gather data on the preferred modes of study of students. Two hundred and fifty-eight students in a

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large variety of academic areas were asked to describe their preferred method of study in reading an article assigned for a class so that a frequency distribution could be constructed. The three frequently described study techniques for reading an article were reading only, reading and underlining, and reading and note taking. These techniques provide the treatment conditions for the present study.

The purpose of this study was to empirically investigate the most efficient techniques or strategies for study by manipulating the three most commonly used study techniques with preferred or nonpreferred assigned methods of study. It also attempted to assess the importance of a later review period or no review time on a delayed test of recall and recognition, as well as the effect of familiarity or lack of familiarity with the general topic assigned for reading on the effectiveness of the three study techniques.

Subjects were 262 college students enrolled in 13 sections of a sophomore Human Growth and Development course. One week prior to the main part of the experiment a questionnaire was administered to all subjects. On the basis of their responses to this questionnaire subjects were assigned to treatment conditions that they either preferred or did not prefer. Half of the subjects were assigned to their preferred method of study and half were assigned to one or the other of their nonpreferred methods of study.

One week later each subject received a packet of materials individually prepared for them. Each packet contained a copy of the article "Love in Infant Monkeys" by Harry Harlow (Scientific American, June, 1959) and instructions on reading the article. All instructions stated that the subjects would be tested later on the contents of the article. The read only subjects were merely asked to read the article. They were instucted not to make any marks whatsoever on the article or to take notes. The read and underline subjects were asked to underline the article as

they read. The read and note taking subjects were asked to make no marks on the article as they read but rather to take notes on the article. A questionnaire enclosed in all packets asked the multiple-choice questions, "Have you read this article before?" and "Have you read any other articles by Harlow or discussed his work in any other of your courses?" Answer selections included "yes," "no," "I think so," and "I don't think so." Subjects who answered "Yes" or "I think so" to either one or both of these questions were classified as familiar with the topic, and subjects who answered "No" or "I don't think so," to either one or both of these questions were classified as unfamiliar with the topic of the assigned reading.

One week following the reading assignment each subject again received an individually prepared packet. Half of the subjects in each of the six conditions above (preferred reading, nonpreferred reading, preferred underlining, nonpreferred underlining, preferred note taking, and nonpreferred note taking) were given a 10-minute review period prior to the examination. The subjects in the read condition received their unmarked copy of the article to review for 10 minutes, the underlining treatment condition subjects received their previously underlined article to review, and the note taking subjects received their previously taken notes to review. The other half of the subjects in each of the conditions above received no review time prior to the examination in order to assess the effect of preferred or nonpreferred study techniques combined with review or no review on delayed recognition and recall learning performance. The test consisted of 15 multiple-choice questions and four essay questions worth four points each for a possible total score of 31 points. A sample of the essays was scored independently by both authors for an obtained reliability of .92.

The study was thus a 3 x 2 x 2 x 2 factorial design. The four independent variables were most common study techniques (read only, read and underline, read and take notes), preferred or nonpreferred method of study, review or nonreview, and familiarity or unfamiliarity with the topic which were combined to form 24 treatment conditions. The mean scores for the multiple-choice items, essay items, and

total score within each of the 24 treatment conditions are presented in Table 1.

An unweighted-means analysis of variance was performed on the dependent variables of number of correct responses on the multiple-choice items, number of correct responses on the essay part of the examination, and total test score (number of correct responses). The results of these analyses are presented in Tables 2,3, and 4. A significant treatment effect was found for the familiarity and unfamiliarity condition for the dependent variables of essay score (F (1, 238) = 8.18, $p < .01$) and total score (F (1,238) = 4.93, $p < .05$). A significant treatment effect was found for the review and nonreview condition on all three dependent variables of multiple-choice score (F (1, 238) = 7.62, $p < .01$), essay score (F (1, 238) = 9.15, $p < .01$), and for the total test score (F (1,238) = 13.00, $p < .001$). A significant treatment interaction was obtained for the interaction of treatment condition and familiarity or unfamiliarity with the topic on all three dependent variables of multiple-choice score (F (2,238) = 7.88, $p < .001$), essay score (F (2,238) = 3.53, $p < .05$), and for the total test score (F (2,238) = 7.75, $p < .001$).

A significant triple treatment interaction was obtained for the interaction of treatment condition, preferred or nonpreferred method of study, and familiarity or lack of familiarity with the topic on all three dependent variables or multiple-choice score (F (2,238) = 3.72, $p < .05$), essay score (F (2,238) = 4.32, $p < .05$), and for the total score (F (2,238) = 6.15, $p < .01$). The mean scores for this significant triple interaction on the multiple-choice dependent variable indicate that reading only is most effective when the subject prefers to read only and is familiar with the topic, and is least effective when the subject prefers to read only but is unfamiliar with the topic. Underlining is most effective when one is unfamiliar with the topic and prefers to underline, and least effective when one is familiar with the topic and does not prefer to underline. Note taking is most effective when one is unfamiliar with the topic and prefers to take notes, and least effective when one perfers to take notes and is familiar with the topic. A basically similar pattern of results was obtained on the total score variable.

The mean scores for the significant triple interaction of treatment condition, preferred or nonpreferred mode of study, and familiarity or lack of familiarity with the topic on the dependent variable of essay score indicate that reading only is most effective when one prefers to read only and is familiar with the topic, while it is least effective when one prefers to underline but is also unfamiliar with the topic. Underlining is most effective when one does not prefer to underline but is familiar with the topic, and is least effective when one does not prefer to underline and is unfamiliar with the topic. Note taking is most effective when one does not prefer to take notes and is familiar with the topic, and least effective when one prefers to take notes and is familiar with the topic.

The results of this study indicate that it is not possible to make a blanket statement about the best study technique for all students in all situations. Instead one must take into account, at the very minimum, the variables of familiarity or unfamiliarity with the topic and whether the student is being asked to use a preferred or nonpreferred study technique as well as the kind of examination to be given. Previous studies have probably failed to find significant effects for one study technique as compared to another one due to their failure to consider the interactions of that factor with other relevant variables.

It is quite possible that a student's success in college may depend on his study skills. Yet previous research has not made it possible to recommend an effective study method to an individual student facing a specific learning situation. This research study makes a beginning stip in that direction.

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Table 1

Means for Multiple-Choice, Essay, and Total Scores by Treatment Condition

Treatment Condition	N	Multiple Choice $\bar{X}$	Essay $\bar{X}$	Total $\bar{X}$
R-UF-P-Re	5	7.40	5.80	13.20
R-UF-P-NRe	6	6.83	3.17	10.00
R-UF-P-Re	14	8.71	7.29	16.00
R-UF-NP-NRe	12	8.08	4.83	12.91
R-F-P-Re	5	11.04	8.20	19.24
R-F-P-NRe	5	9.25	9.25	18.50
R-F-NP-Re	19	9.00	7.84	16.84
R-F-NP-NRe	21	8.32	5.91	14.23
U-UF-P-Re	12	9.50	6.67	16.17
U-UF-P-NRe	10	9.30	6.70	16.00
U-UF-P-Re	5	9.00	6.80	15.80
U-UF-NP-NRe	10	7.90	5.40	13.30
U-F-P-Re	17	8.82	7.53	16.35
U-F-P-NRe	17	8.18	6.29	14.47
U-F-NP-Re	13	9.38	8.00	17.38
U-F-NP-NRe	6	6.83	7.00	13.83
N-UF-P-Re	6	10.33	7.50	17.83
N-UF-P-NRe	5	8.60	5.80	14.40
N-UF-NP-Re	11	9.27	6.73	16.00
N-UF-NP-NRe	13	9.62	5.38	15.00
N-F-P-Re	6	8.50	6.00	14.50
N-F-P-NRe	8	8.75	5.63	14.38
N-F-NP-Re	17	8.71	7.59	16.30
N-F-NP-NRe	19	8.84	6.32	15.16

R = Read
U = Underline
N = Notes
UF = Unfamiliar
F = Familiar
P = Preferred
NP = Nonpreferred
Re = Review
NRe = Nonreview

Table 2

Unweighted-Means Analysis of Variance
for Multiple-Choice Score

Source of Variation	SS	df	MS	F
A	9.40	2	4.70	1.12
B	.72	1	.72	< 1
C	3.58	1	3.58	< 1
D	31.86	1	31.86	7.62**
AxB	66.00	2	33.00	7.88***
AxC	4.67	2	2.34	< 1
AxD	7.57	2	3.78	< 1
BxC	6.90	1	6.90	1.65
BxD	1.08	1	1.08	1
CxD	.11	1	.11	3.03
AxBxC	31.11	2	15.56	3.72*
AxBxD	8.84	2	4.42	1.06
AxCxD	14.29	2	7.14	1.71
BxCxD	.97	1	.97	< 1
AxBxCxD	7.61	2	3.80	< 1
Within Cell	996.23	238	4.19	

* < .05

** < .01

*** < .001

A = Study Technique

B = Familiarity

C = Preference

D = Review

Table 3

Unweighted-Means Analysis of Variance

for Essay Score

Source of Variation	SS	df	MS	F
A	6.36	2	3.18	< 1
B	63.81	1	63.81	8.18**
C	.11	1	.11	< 1
D	71.32	1	71.32	9.1****
AxB	55.00	2	27.50	3.53*
AxC	1.46	2	.73	< 1
AxD	2.95	2	1.48	< 1
BxC	.38	1	.38	< 1
BxD	7.84	1	7.84	1.01
CxD	7.23	1	.72	< 1
AxBxC	67.42	2	33.71	4.32*
AxBxD	13.58	2	6.79	< 1
AxCxD	2.85	2	1.42	< 1
BxCxD	2.65	1	2.65	< 1
AxBxCxD	12.46	2	6.23	< 1
Within Cell	1,855.44	238	7.80	

* < .05

** < .01

*** < .001

A = Study Technique

B = Familiarity

C = Preference

D = Review

TABLE 4

Unweighted-Means Analysis of Variance

for Total Score

Source of Variation	SS	df	MS	F
A	3.58	2	1.79	< 1
B	76.34	1	76.34	4.93 *
C	2.77	1	2.77	< 1
D	201.31	1	201.31	13.00 ***
AxB	240.14	2	120.07	7.75 ***
AxC	8.02	2	4.00	< 1
AxD	9.02	2	4.51	< 1
BxC	9.88	1	9.88	< 1
BxD	3.46	1	3.46	< 1
CxD	5.09	1	5.09	< 1
AxBxC	190.30	2	95.15	6.15 **
AxBxD	23.26	2	11.63	< 1
AxCxD	16.47	2	8.23	< 1
BxCxD	7.35	1	7.35	< 1
AxBxCxD	9.63	2	4.82	< 1
Within Cell	3,685.53	238	15.49	

* < .05

** < .01

*** < .001

A = Study Technique

B = Familiarity

C = Preference

D = Review